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Second Generation Phosphorus: Its Role In Sustaining Food Production Chain

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Phosphorus: An Important Nutrient And Pollutant

Phosphorus (P), in addition to being necessary for life, is also vital to industry and the global food production system. Over the past few years, phosphorus (P) has drawn more and more attention in the global context. The first generation of phosphorus includes the primary P source that is extracted from the P-bearing minerals. Population growth has raised the demand for food production, which has put more pressure on the agricultural industry to produce more tofulfill global demands. The inefficient and non-judicious use of P in the agriculture sector paved the way for P to aquatic bodies causing eutrophication. In aquatic ecosystems, the build-up of nutrients like P encourages the growth of algae, which threatens the sustainability of the local environment by creating hypoxic dead zones. It is estimated that 1-3.1 Tg year-1 of P is deposited in sediments of freshwater bodies (Hollas et al., 2021;Sarvajayakesavaluet al., 2018).

Role Of Second Generation Phosphorus

The take-make-trash economy continues to be the most common activity worldwide and waste generation is rising drastically in the modern world.By 2050, there is no indication that the amount of garbage produced worldwide will significantly decrease. So, the focus has shifted to circular economy from linear economy.A global 5R stewardship strategy (Realign P inputs, Recycle P in bioresources, Reduce P losses, Redefine P in food production systemsand Recover P from wastes) was proposed by Withers et al., (2015), who also concluded that implementing the 5R strategy would make society more resilient, competitive, sustainable, and health-conscious. The boost in water pollution, the non-renewable nature of phosphatic rock and the rising price level of P fertilizer are the major drives for efficient utilization of second generation.

Source Of Second Generation Phosphorus And Recovery Technologies

There are numerous secondary P resources out of which only four have the potential for phosphorus recovery viz. animal waste, sewage sludge including wastewater, mining waste and food waste (Fig 1). The removal and extraction and/or recycling of P from the waste materials include techniques viz. electrocoagulation, electro flocculation, nanofiltration, ion exchange and /or sorption, thermal treatment, precipitation and biological means like composting and enhanced biological P removal (EBPR) (Hollas et al., 2021; Lee et al., 2018).It is possible to recover phosphorus from sludge ash, liquid phase, and sludge phase. To recover phosphorus from liquid wastes, several processes have been developed, including chemical precipitation, crystallization and biological P removal.Processes like sludge digestion, struvite precipitation, and acidification have been widely used in solid waste recovery. Phosphorus has been recovered from sludge ash using thermomechanical and dry thermal processes (Sarvajayakesavaluet al., 2018; Desmidtet al., 2015) (Fig 2).

Conclusion

Phosphorus recovery from waste and wastewater is shown to have significant positive effects on the environment and the economy. Reducing reliance on inorganic compounds obtained from phosphate rock is a key strategy for ensuring that human activities remain sustainable in the long run.Since technologies have a promising future and there are opportunities for process development and optimization to maximize productivity and curtail costs, the circular perspective of the chains presents a chance to complete loops in recovery.

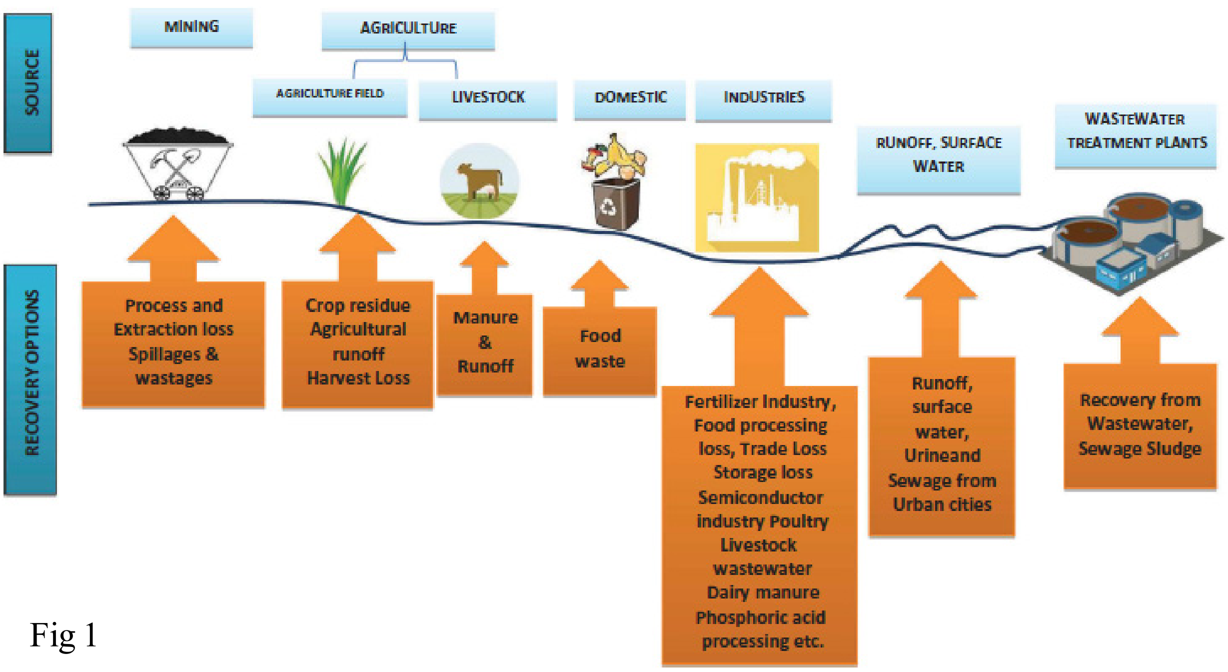

Fig 1

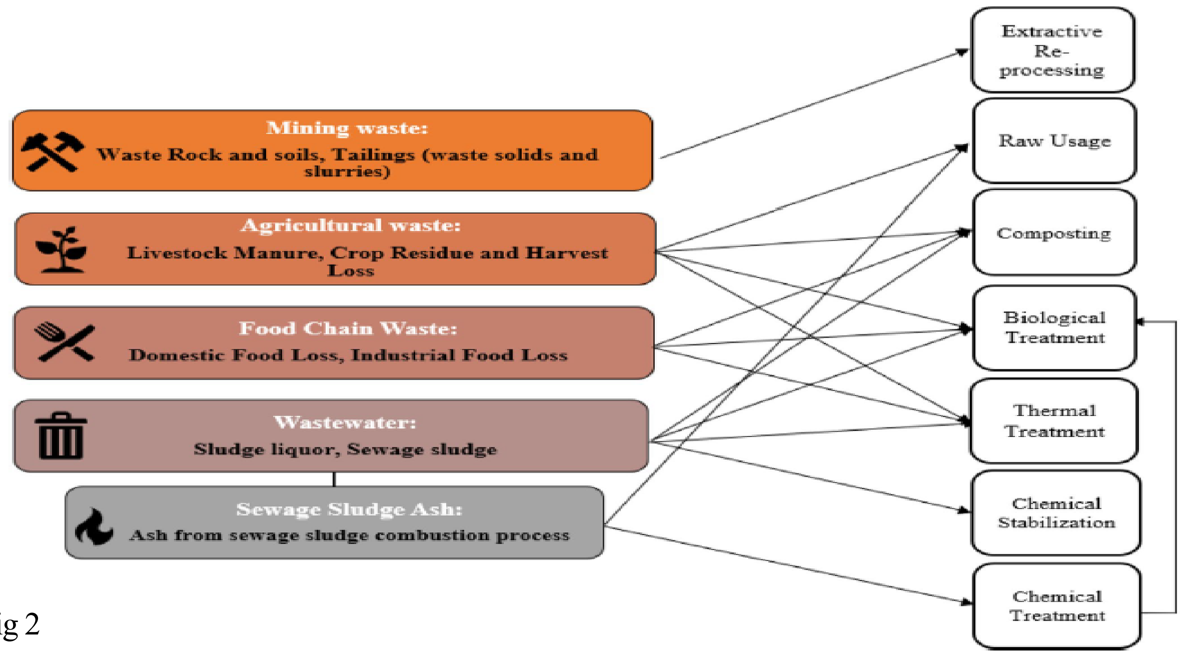

Fig 2

Referances

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